Summer 2011 ENSO Discussion and Outlook

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The Ohio Valley region has experienced a very wet and, at times, cool spring season. Many factors can influence our daily weather and the large scale global atmospheric circulation patterns (i.e. the jet stream – the corridor of high winds in the upper atmosphere) that "drive" the weather. One of these factors is the El Nino Southern Oscillation (ENSO), which is denoted by anomalous sea surface temperatures (SSTs) in the eastern equatorial Pacific Ocean. ENSO is commonly referred to by its positive (warm) and negative (cool) phases: El Nino and La Nina, respectively. For approximately the past year, the Pacific has been in a La Nina pattern. (See this link for more information on La Nina.) The cooler SSTs influence the wind patterns over the Pacific, which in turn can impact the Northern Hemisphere jet stream. In a La Nina circulation pattern, the jet stream often becomes amplified over the eastern North Pacific Ocean and North America, meaning stronger ridges and troughs. Often, "blocking" patterns can result, which lead to the upper level flow pattern becoming stagnant and persistent over these regions. Climatologically in La Nina winters, a trough of low pressure is favored over the eastern United States. Depending on other factors not discussed here, this pattern can favor active storm tracks for the Ohio Valley and above normal precipitation (Fig. 1).

ENSO impacts are generally weaker over North America during the summer months. However, after an active and abnormal spring, many people are wondering what the summer has in store.

During the spring months, the La Nina episode has been gradually weakening, with warmer SSTs beginning to appear in the far eastern Pacific (Fig. 2). The weakening anomalies (warming SSTs) can be seen in all regions of the equatorial Pacific, as shown in Fig. 3. However, the impacted global circulations can take longer to respond, which may be part of the reason active weather has continued during the late spring time frame. Computer model forecasts (which are specifically tailored to predicting ENSO) support a trend to ENSO-neutral conditions through the summer months (Fig. 4). This simply means neither prevalent El Nino nor La Nina conditions are expected. So what does this mean for the Ohio Valley? Figs. 5 and 6 are box and whisker plots showing the range of temperatures and precipitation in the Ohio climate division during El Nino, Neutral, and La Nina periods during the months of June, July, and August. These plots show the range of observations during each of the three categories. The "box" part of the diagram indicates the middle 50% (most likely range) of observations, with the majority of the remainder observations occurring along the "whiskers." Temperatures during ENSO-neutral summers are similar to La Nina summers. Precipitation during ENSO-neutral summers is generally higher than during summers with strong ENSO events. Note that these charts are designed in reference to ENSO events and not to seasonal averages.

With the more limited influence from ENSO, other factors are considered when making seasonal forecasts. One of these is soil moisture. The ground is saturated after high rainfall totals this spring. Wet soils absorb more of the sun's energy, evaporating the water, thus reducing the amount of energy that can go into warming the air. Also, as the moisture in the soil is transferred into the atmosphere, it leads to more humid air. Moisture-laden air requires more energy to warm, which can also limit temperature rises, and can also produce more thunderstorms. This soil moisture is one reason why the Climate Prediction Center (CPC) (producer of the official

long range forecast for the National Weather Service) has a below normal temperature outlook extending toward the Ohio Valley (Fig. 7). In terms of precipitation, there aren't any strong climatic signals, so the CPC has the region under "equal chances" of above or below normal precipitation (Fig. 8).

There are other considerations which include climate prediction computer models and long term decadal trends. This particular forecast from the CPC (issued May 19, 2011) was the first to use the 1981-2010 period for the climatic normal (it is standard practice to use the previous three decades as the normal period). It is interesting to note that this change from using the 1971-2010 period impacted the "trends" portion of the forecast with this issuance. For example, some areas now have "equal chance" probabilities due to the fact that previous decadal trends have become the new "normal." Keep in mind that these are seasonal trend forecasts and that daily and weekly weather will vary significantly. For example, a weather pattern may develop which allows several days, or even weeks, of much above normal temperatures. Therefore, don't expect the entire summer to be cool just because of the prediction for below normal temperatures. More information on seasonal forecasts can be found at http://www.cpc.ncep.noaa.gov.

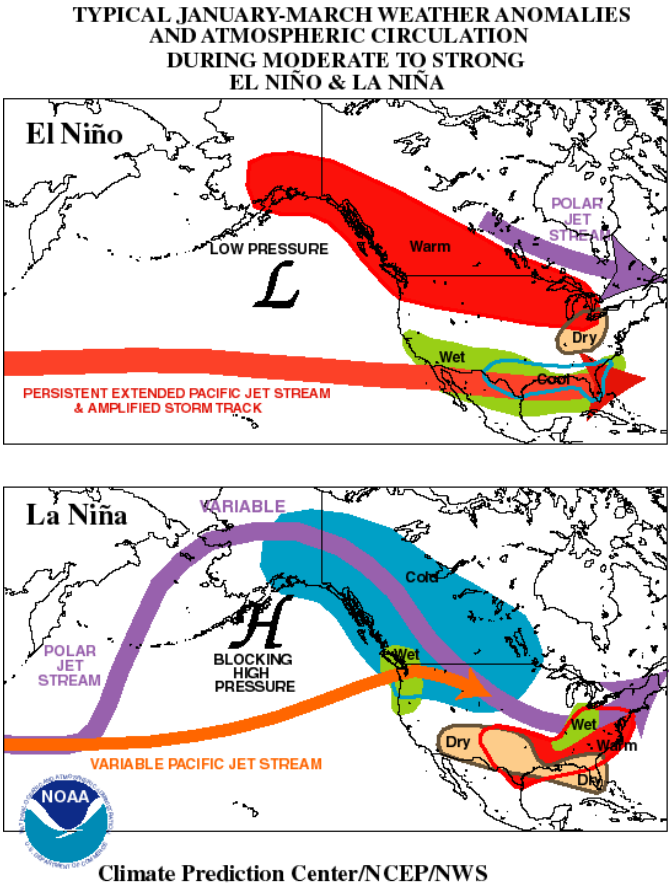

Fig. 1. Jet stream patterns during El Nino (top) and La Nina (bottom) winters.

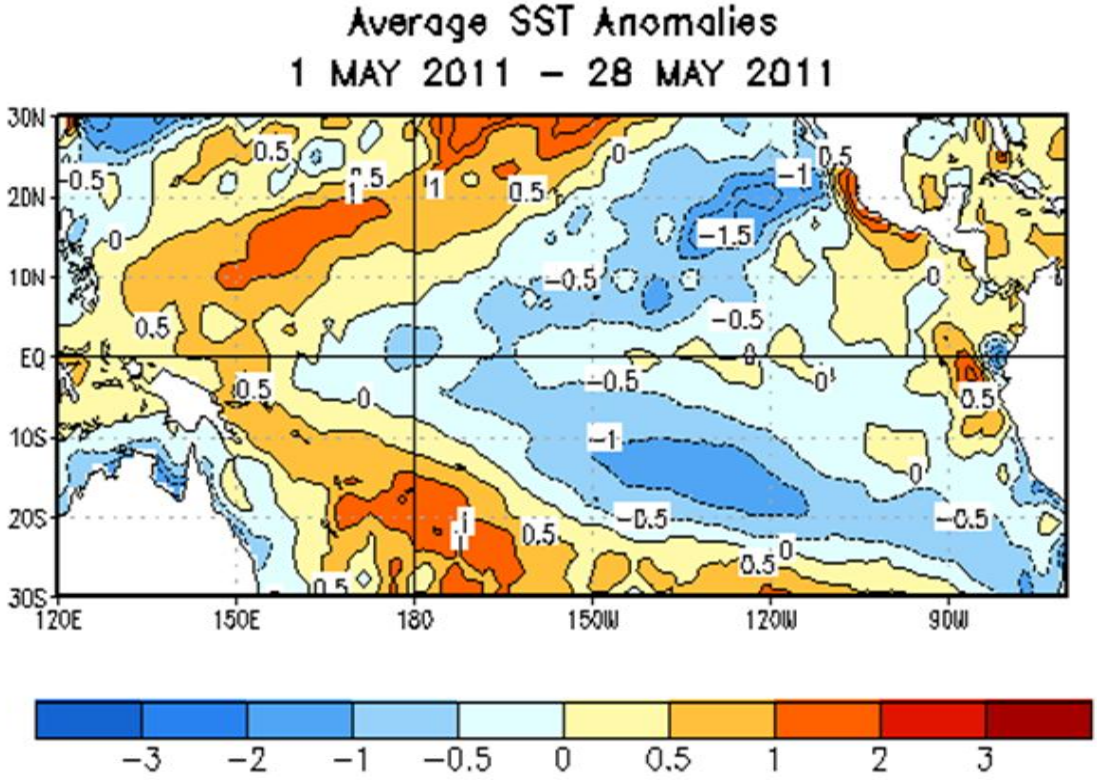

Fig. 2. SST anomalies over the equatorial Pacific during May 2011. Reds indicate above normal SSTs, while blues represent below normal values. The current values are very close to zero over the eastern Pacific Ocean (right center of map). Image courtesy of CPC.

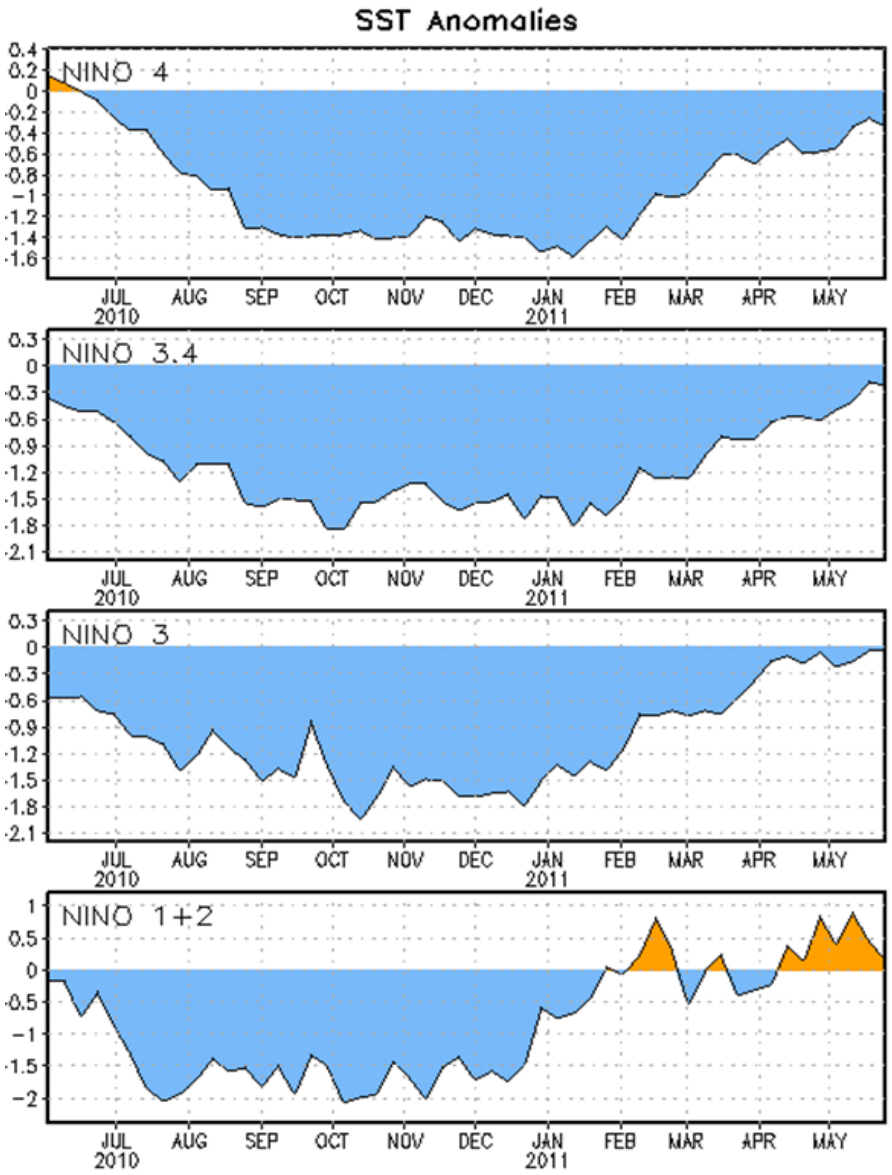

Fig. 3. SST anomaly trends over various regions of the equatorial Pacific Ocean over the past year. The blue color indicates cooler than normal SSTs, but notice that the values have been trending toward zero in recent months (right side of graphs). Image courtesy of CPC.

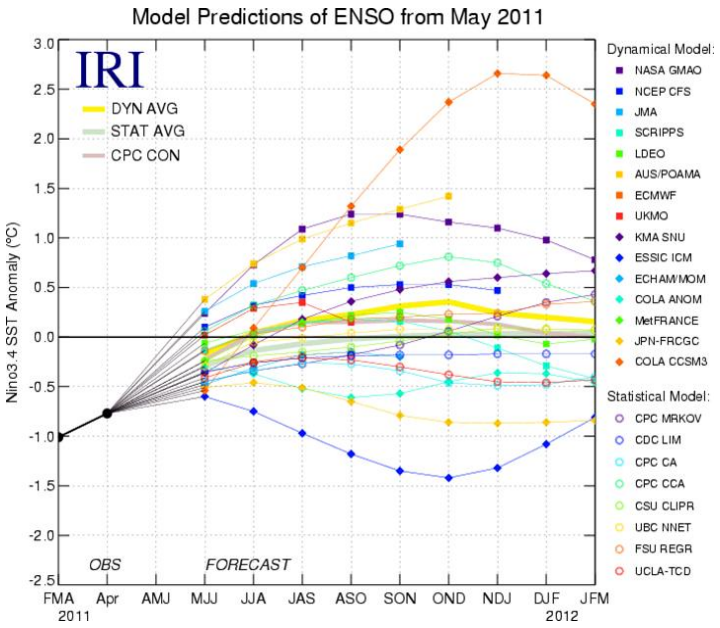

Fig. 4. Computer model forecasts of ENSO conditions. Each line represents a different computer forecast of SST anomalies. El Nino occurs with persistent anomalies of greater than 0.5ºC, while La Nina has persistent anomalies less than -0.5°C. Note most of the forecasts are centered around 0 (solid line – ENSO neutral) and generally stay neutral through the remainder of 2011. Figure provided by the International Research Institute (IRI) for Climate and Society (updated 17 May 2011).

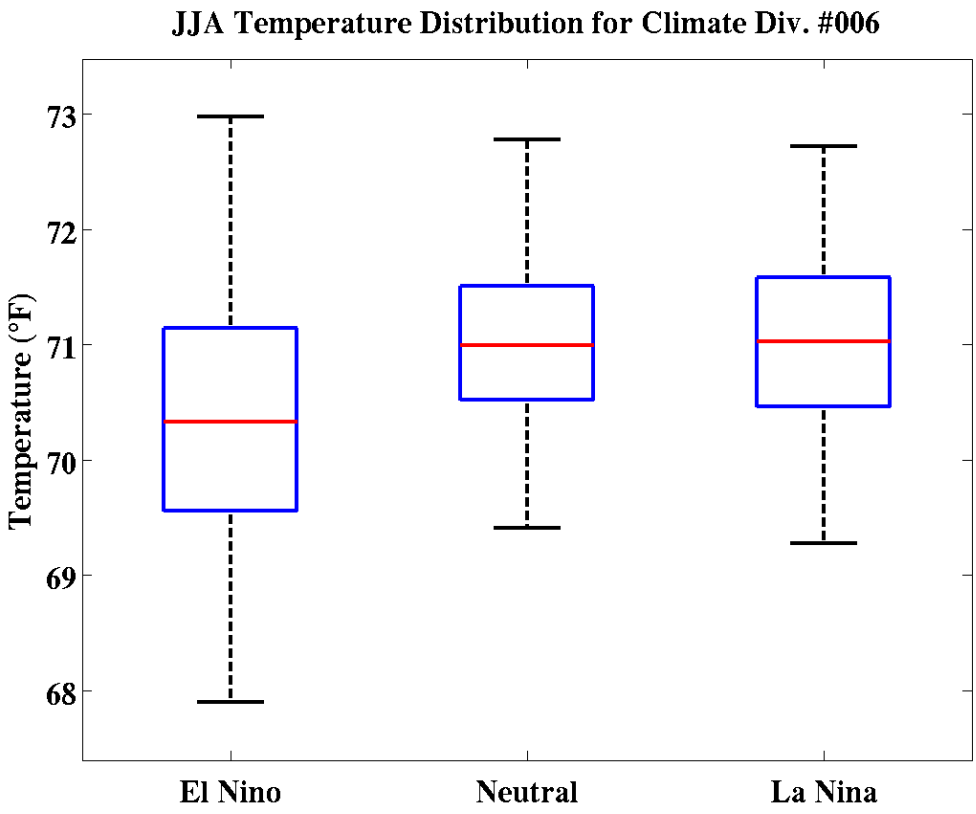

Fig. 5. Summer temperature distributions for the Ohio climate division based on ENSO activity. The temperature distributions (size of the box and whisker plot) are similar for both netural and La Nina summers. While on average El Nino summers are cooler (the median, or red line, is lower on the scale), a wider range of observed temperatures have occurred (longer "whisker" portion of the plot). Image courtesy of CPC.

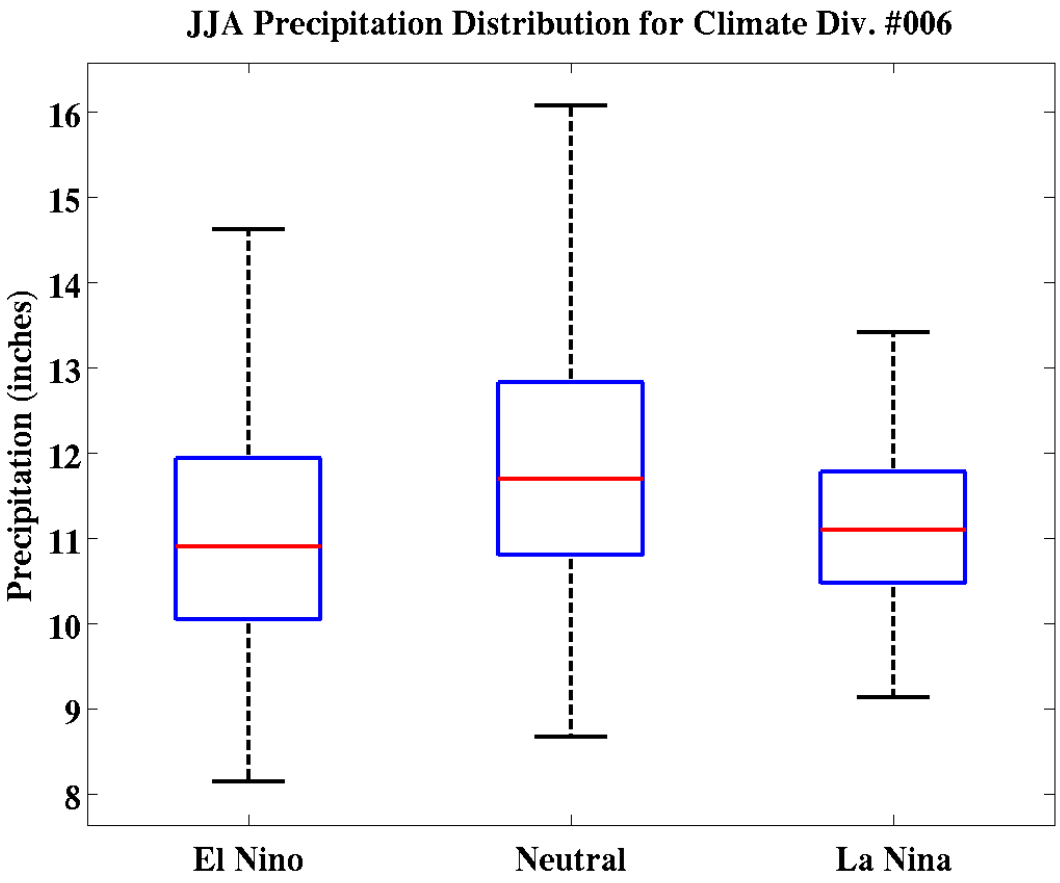

Fig. 6. Summer precipitation distributions for the Ohio climate division based on ENSO activity. The median (red line) of precipitation amounts has been higher during neutral summers than summers with ENSO activity. However, the distribution of observations (vertical extent of the plots) covers similar values for all three categories. Image courtesy of CPC.

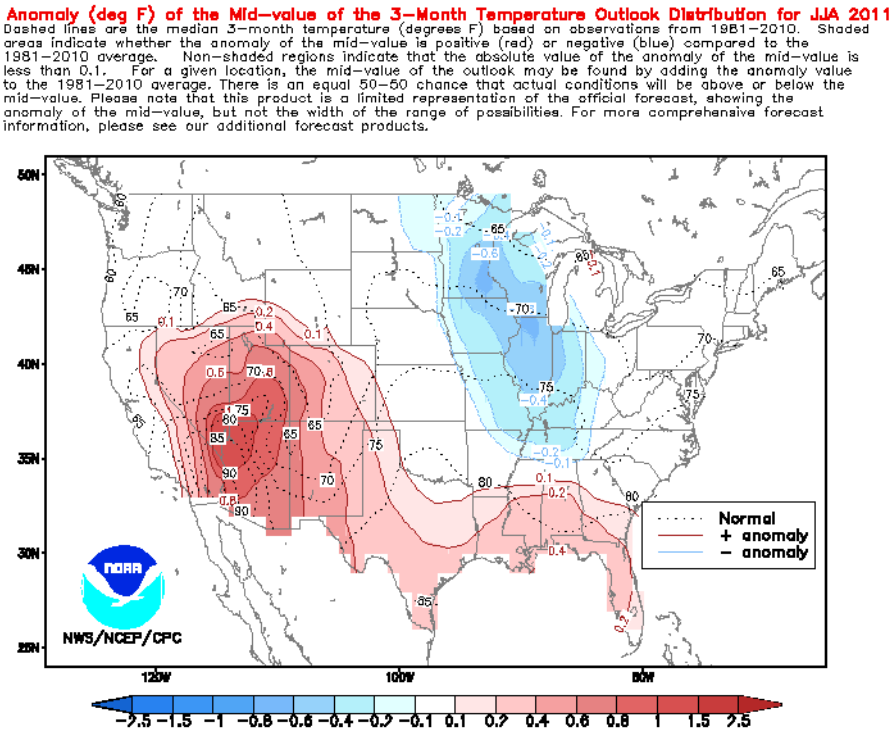

Fig. 7. Summer temperature anomaly outlook. Blue shading indicates areas where temperature anomalies this summer are expected to be negative (below normal), while red shading indicates areas of expected positive anomalies (above normal temperatures).

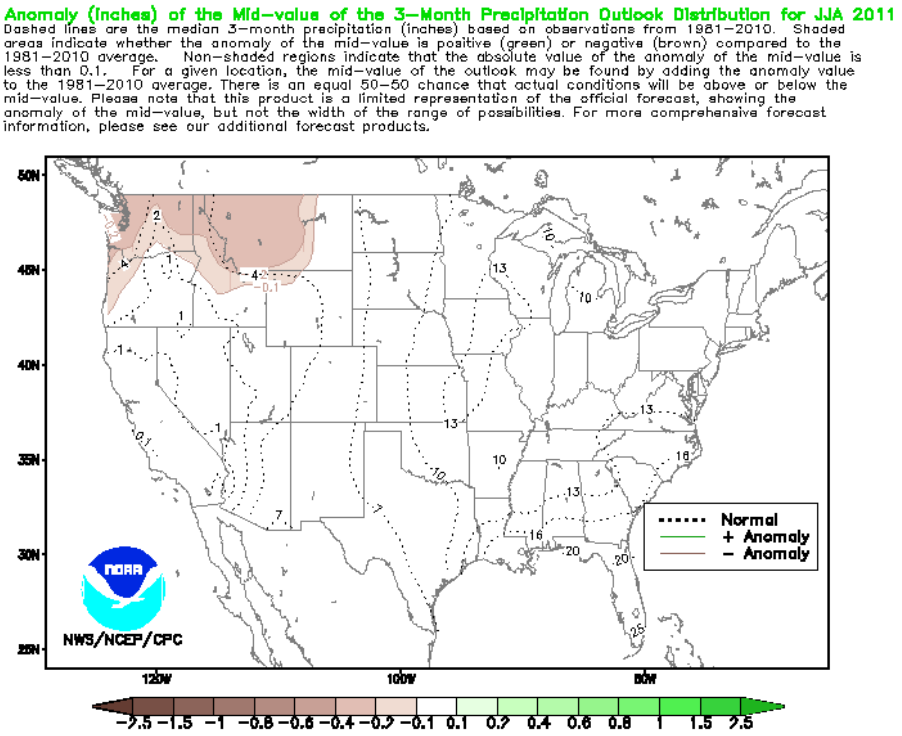

Fig. 8. Summer precipitation anomaly outlook. Brown shading indicates below normal precipitation, while green shading represents above normal precipitation. Since much of the country is unshaded, near normal precipitation is expected. However, it can also mean there are not strong signals that either a wet or dry summer will occur.